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CHAPMAN

DESERTS OF NEVADA

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THE DESERTS OF NEVADA

AND

THE DEATH VALLEY

BY

ROBERT H. CHAPMAN

UNITED STATES GEOLOGICAL SURVEY

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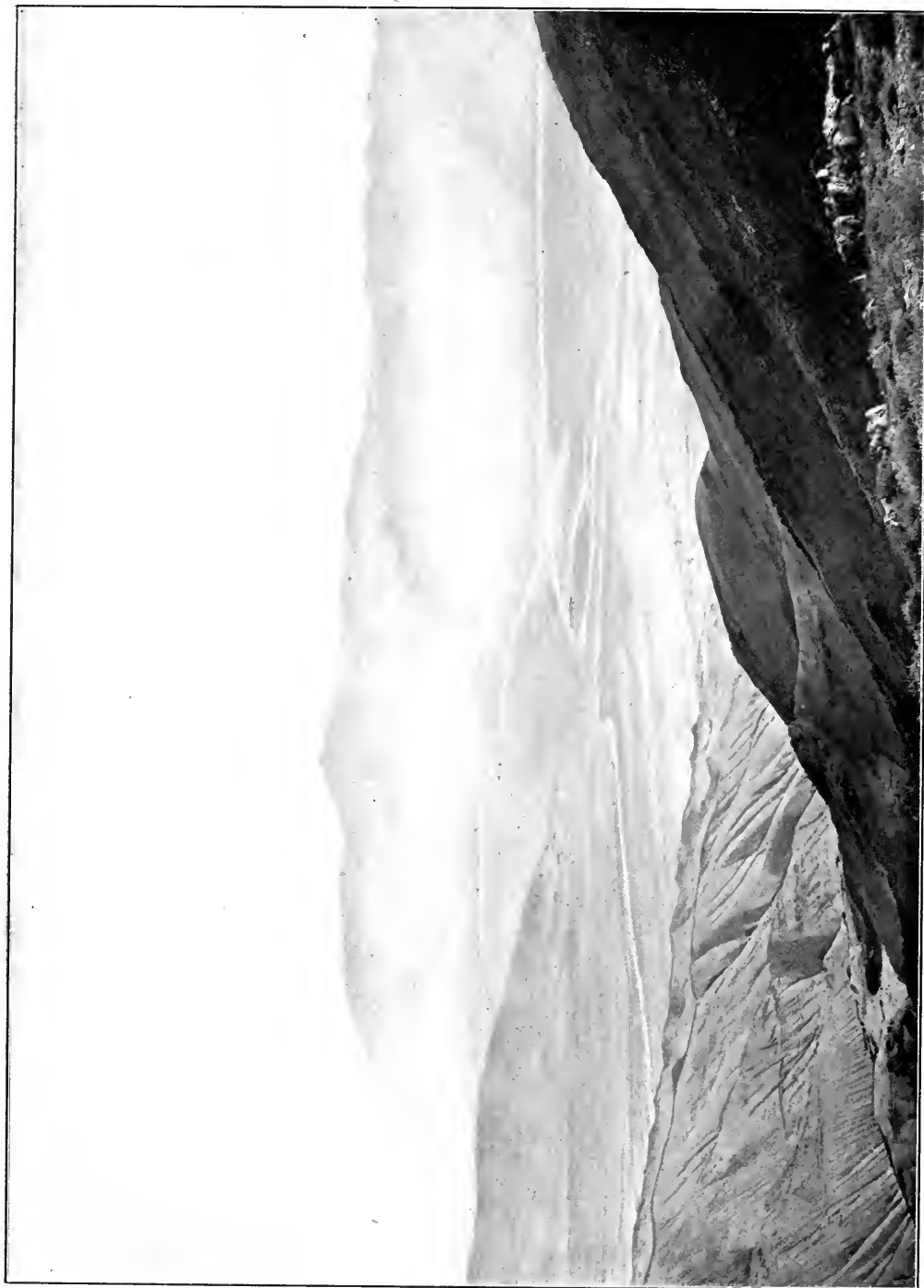
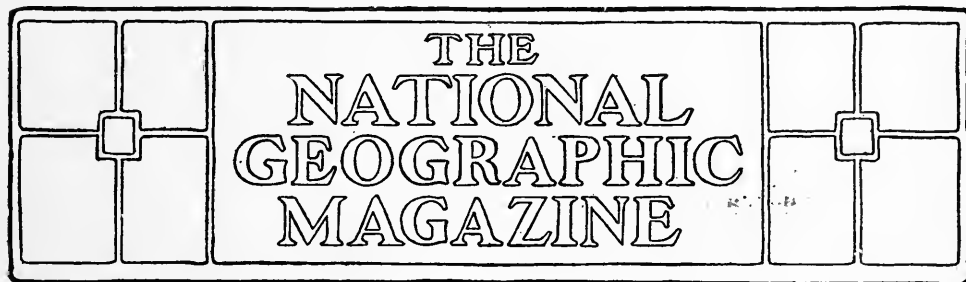


Photo by Robert H. Chapman

Death Valley from Summit of Grapevine Range
Telescope Peak in background is 40 miles from camera



THE DESERTS OF NEVADA AND THE DEATH VALLEY*

"AND STILL THE DESERT WAITS"

BY ROBERT H. CHAPMAN

U. S. GEOLOGICAL SURVEY

THE area lying to the west and southwest of Salt Lake City and extending to the Sierra Nevada and the ranges east of Los Angeles was for a long time included under the caption "The Great American Desert."

The discovery of gold in California in 1849 was the beginning of the conquest of this thirsty region, the direction of greatest travel being but little south of west from Great Salt Lake to the vicinity of the Donner Pass in the Sierra Nevada, since used by the Central Pacific Railroad in crossing this range. In seeking for better routes to the new El Dorado, parties journeyed southward across the wastes of sand and rock searching for the lower passes which would be perennially available. In this direction the number of mountain ranges to be crossed is largely increased, but by going well southward the great wall of the Sierra Nevada is escaped, though the desert journey is very much lengthened and the hardships encountered by many parties were most appalling.

The desert took frequent toll in the lives of man and beast, and indeed does sometimes today, though the dangers are now comparatively insignificant.

With the discovery of the Comstock mines there came a period of tremendous activity in the search for the precious metals, more particularly for silver, and much of the desert region was traversed by the hardy prospector and his burro. In this way the long distances between watering places were divided by the discovery of springs and "tanks" (natural reservoirs), and gradually this part of the "American Desert" diminished in area and lost some of its fearfulness.

In the 60's and 1871-'72 government expeditions under Lieut. George M. Wheeler traversed several routes across the desert, making topographic sketches and notes of interest and value, but few complete maps were printed. In 1865, and several times since then, the boundary line between Nevada and California was run, which cut through much of the most difficult country. The reports of

*An address to the National Geographic Society, March 24, 1906. Published by permission of the Director of the U. S. Geological Survey.

and the stories by members of these expeditions did not tend to populate the region with great rapidity.

In many instances the prospectors were successful, and the camps of Silver Peak, Lida (or Allida), Reveille, and others sprang up, and had their periods of rise, prosperity, and decline, many becoming completely uninhabited.

During the period of activity many travelers became permanent residents, took to wife dusky maidens from the Indian tribes, and located ranches at various springs and streams, oases in the expanse of waste, where small herds of cattle or horses were maintained.

From the eastward the Mormons pushed gradually away from the streams of southern Utah and established farms and ranches at such places as furnished water, but there is a belt of country one hundred miles or more in width between these points and the water-fed valleys at the foot of the Sierra Nevada, which is almost wholly barren and very dry.

RENEWED INTEREST IN THE DESERTS

During the last few years, beginning with the discovery of valuable ore at Tonopah (in May, 1900), the attack upon the desert has been renewed with great vigor and earnestness, and the efforts of the seeker of Fortune met with so much success and at such widely separated points that it was decided by the officers of the Geological Survey to put parties in the field to make a reconnaissance of some of the unmined desert area.

The area where work was done lies about 200 miles southeast of Carson City, about 350 miles southwest of Salt Lake, and 250 miles northeast of Los Angeles. It comprises about 8,600 square miles and has a great range in elevation; the highest point reached is 9,500 feet above and the lowest about 300 feet below the level of the sea.

The idea of the person unacquainted with American deserts is of a great plain, sand-covered or rock-littered, with nothing to relieve the monotony of the horizon. As a matter of fact, these great

areas include mountain ranges, high plateaux, mesas, and buttes, extensive valleys, that in the clear air seem but a short distance across. Many of these valleys are "closed"—have no outlet—and the lowest pass from one to another is often many hundred feet above the valley floor. The flowing streams are very few, the springs far between, and water a commodity for which men search, often with life at stake.

The map includes an area, almost equal to the total area of Delaware and Rhode Island, of 3,000 square miles that is waterless except for small holes that may be filled by occasional rains.

LIFE IN GOLDFIELD, NEVADA

In entering the desert area the party traveled by rail to Tonopah, and thence by auto to Goldfield, which a short time ago was but a cluster of tents, and here headquarters camp was established. The town lies at an elevation of 5,700 feet, in a basin between the foot of Columbia Mountain and a mesa edge several hundred feet high. The immediate vicinity is not of great ruggedness, differences of 800 feet being extreme, though eight miles westward the Montezuma Peak rises to a height of 8,400 feet above sea.

Since January, 1905, the town, together with its sister, Columbia, has "boomed" and quieted, and been "born again" to a steady, healthy growth. The demands of business are such as to warrant the erection of substantial buildings of wood and stone; there is at least one church, an ice plant, swimming pool, a brewery, a club; pipe lines bring water from distant springs, and there are the numerous sources of amusement common to all new mining camps; every bar and hotel has its roulette wheel and corps of players, "cappers," etc. Here one may eat most of the dainties of the season—fruits from California, vegetables from Utah, fresh meat from Chicago; he may drink almost any brand of wine or any mixture of liquors to be found anywhere, while selections from the latest operas are rendered on violins and piano. One meets

men from every part of the globe—prospectors from Alaska, mining engineers from London and Africa, business men from every large city, and the burros, “angels” of the desert, are universally present. There are numerous mines producing ore, some of which is shipped for treatment, some crushed in local “custom” mills, and some by mills controlled and operated by the owners of the mines. (Gasoline is used for power in most cases; wood retails at \$18.00 per cord.)

Insurance is unknown, regular companies declining the risk. On a windy day in July (8th, 1905) a fire was started which destroyed several blocks of tents and buildings. It is a matter of interest that at least one building was saved by using beer to prevent its igniting; the bottles were thrown against the building as modern grenades are used. One week later the town of Columbia was severely damaged by fire, the roaring flames, flying sparks, with pyrotechnic explosions of dynamite, making a scene to be remembered.

It is the dustiest vicinity I have seen, and when one of the many “twisters” (cyclones often of no mean proportion) strikes one, he can only “shut up” everything about himself and do no breathing until it goes by.

Provisions are high priced and hay worth 2 cents to 3 cents per pound.

With the advent of the railroad in Goldfield, and from this point to outlying camps, the means of transportation is varied—for the passenger the modern high-power automobile or the more primitive stage-coach. For freight supplies of all kinds for man and beast, traction engines hauling trains of wagons, or several coupled wagons drawn by six to eighteen horses or mules, are used.

Nowhere in the world can one find greater contrasts than in this region. But a few miles from town one may ride or drive for hours—perhaps days—without meeting a human being, his eyes aching with the brazen glare and the monotony of the billowing hills and mountains,

which hours of travel seem to bring no nearer.

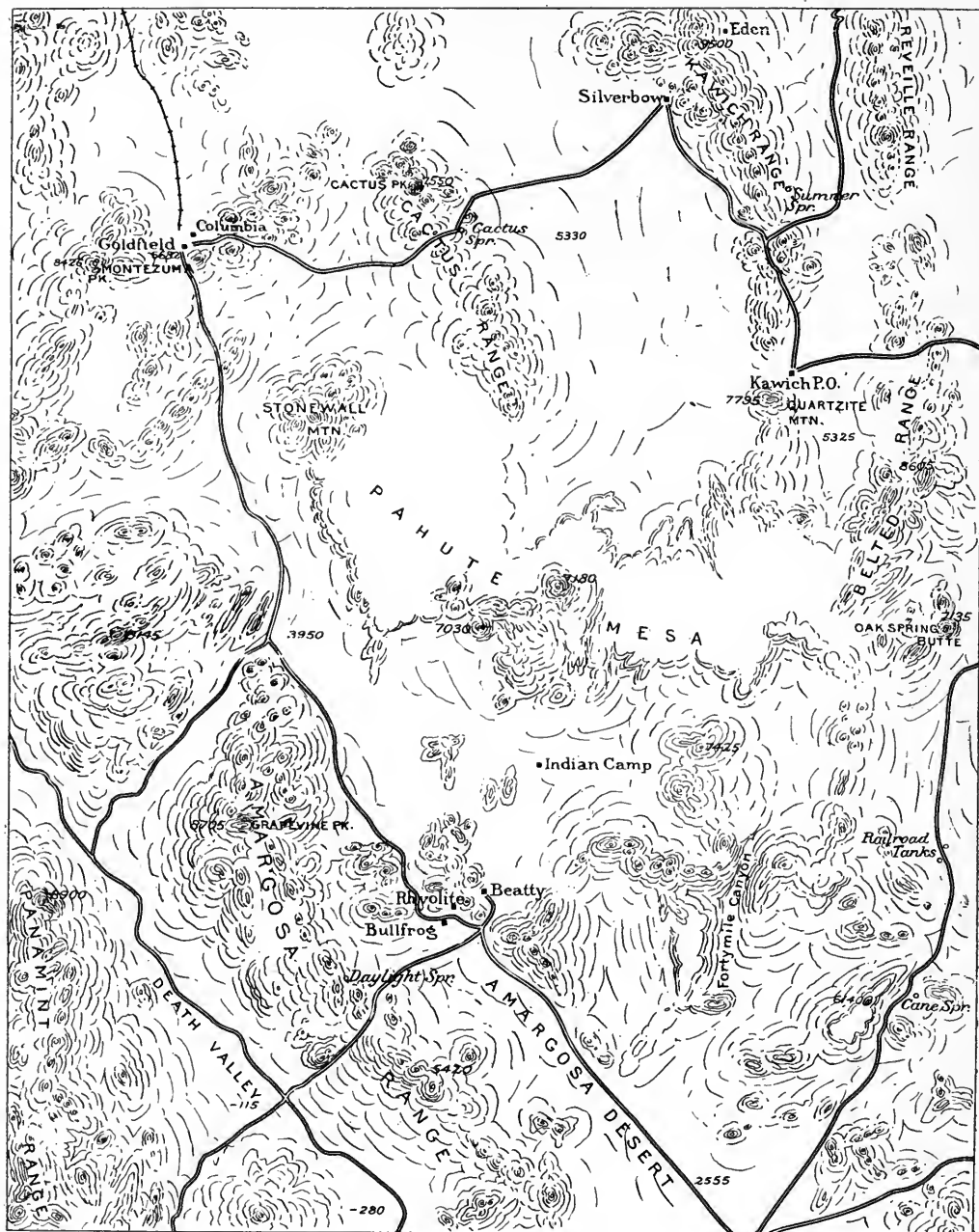
THE STONEWALL FLAT

From Goldfield the work of mapping takes us to the eastward, away from the auto and freight roads to Bullfrog and the southern camps. Across the Stonewall flat—a great inclosed valley, with its playa bottom of baked mud as hard and as smooth as concrete and as white as snow—to the Cactus Range, which extends in a northwest-southeast direction, with a rugged rock cone at the north end, known as Cactus Peak, which is a landmark for an area of a thousand square miles. An example of the uselessness of the maps of the region is here apparent; all these show the Cactus Peak to be to the south of Cactus Spring, which is the first water east of and 25 miles from Goldfield, while in reality the water is eight miles south of the mountain. This spring we find to be high in the range, and in this it is typical. Palatable water is seldom found in the flats or valleys unless sought by wells of considerable depth (100 to 200 feet). This range is made up of a series of volcanic flows, and near the Cactus Spring we find a fine example of basalt or rhyolite, columnar structure, lying like cordwood beside the road.

The Cactus Range is separated from the Kawich Range by a great valley, like that of Stonewall, long slopes of gravel and drift reaching from the ranges to the flats in the middle, which, as looked upon during the day, swing, rise and fall, in hazy heat waves like the billows of the sea. Toward the north end of the Kawich Range, at the new townsite of Silverbow, we find a stream of running water, and we push on to get above the camp and pitch our tents below the ragged cliffs.

At Silverbow and vicinity there are several hundred men, a few women, many good prospects, and much hope. The place is about as comfortable as any in the region, but desert prices prevail; hay is worth \$80.00 per ton in bulk and grain \$5.00 per sack (of 75 pounds).

•Tonopah



The Death Valley Region, Nevada

To the east is the trail to "Eden," which we follow, crossing the Kawich Range, the highest peak of which is 9,500 feet.

From the pass we look along the summit, which is flat and broad—the remnant of an old surface which has been much eroded. We find the "town" to be a scattering lot of tents, but aptly named, for there is a small creek of running water, green, fresh grass, willows and small cottonwood trees, rose bushes, ferns, and grateful shade. The first man we greet states his name to be Adam(s), and asks us if we have seen any snakes, of which he assures us there are plenty, but Eve and apples we do not find.

The prospectors here show us claims, some having ores of gold and others of rich silver. We spend some days in mapping this country and examining the rocks, and then take up our journey southward along the range, which is usually supplied with timber, springs, and grass. Here there are numerous bands of horses, some of them wild, others acquiring wildness, and in turn endeavoring to thrust wildness upon the beasts of the traveler (three of ours strayed and are not even yet recovered). At one spring seven dead animals are found, killed by the shots of the stock-owners, who wish the water for beasts of use and value. Like the Cactus, this range is largely made up of volcanic flows.

We cross the Kawich Range on the pass above the "Wild Rose" Spring, and camp at the Sumner Spring, where there is water and wood, and after removing various rats, gophers, and insects from the spring, we are well located, with a beautiful view of the Reveille Range, which rises 3,000 feet above the valley to the eastward. In the desert it is very difficult to get satisfactory photographs—the distances are so great that the picture may include a whole range, miles away and several thousand feet high, but there is nothing to give scale to the view—nothing by which one can measure it. In the Reveille and adjacent valleys

antelope are sometimes seen, but animal life is not abundant.

From Sumner Spring we journey by buckboard to the Reveille Range, which is crossed by the steepest wagon road I have ever seen. Over this road the ores from the mining camp, Old Reveille, were hauled to the mill in the valley, 16 miles away.

At the top of the mountain we look across another rolling summit of volcanic rocks; near by are a few buildings, a new boarding house, and several wooden shelters. Here "outside" capital is interested in the development of "prospects;" the water is hauled four miles, from the spring at the "Old Camp," which thirty years ago was a busy town, but now going to decay.

Horses and mules unaccustomed to the region are afraid of the deserts, and it is often very difficult to get them started over an unknown road when leaving a good campground behind; a nerve-wrecking delay may follow and heroic measures become necessary. Some of our animals lay "hog tied" in the cooking sun for hours before proceeding over a new route.

KAWICH—A GOLD CAMP

While the northern end of the Kawich Range is well supplied with water, grass, and trees, the southern part is dry and barren. Here, about 80 miles from Goldfield, at the foot of Quartzite Mountain, some of the ledges of rhyolite which show through the drift carry gold, and as this is the magician that turns a desolate waste into a semblance of civilization, we find a camp, complete, yet lacking everything. The description of an investor from Italy I quote: "Kawich is a hell of a place! No mines, no water, no feed, no women," which discloses one point of view.

The water is hauled by team from Cliff Springs, 12 miles away, making a journey of 25 miles a day to keep the town from drying up, and is sold at \$3.00 per barrel. (Extensive bathing is not generally practiced.) If this spring fails,

the wagons go to the Wild Rose Spring, 16 miles distant.

At the Gold Reed Mine we see some very beautiful gold ore; the metal occurs in a ledge of rhyolite which is highly silicified, and there is so much of it that none need ask to see it.

The Belted Range lies east of the Kawich Valley. It is composed of volcanic rocks, which weather in cliff forms that are very beautiful, many reaching 1,500 feet in height. Many rocks show columnar structure, horizontal, curved, and vertical, when looked at more closely.

The valley at Kawich extends southward many miles, and then rises to a high table-land which breaks abruptly to the south, forming a mesa front. To the eastward the Belted Range runs about north and south, and where it joins the mesa land the Oak Spring lies. A butte known as Oak Spring Butte rises just north of this water—a landmark; it is at once an aggravation and a comfort to the traveler, as he can see it for miles, and journey apparently toward it, circle around it, but not reach it.

Oak Springs is about sixty miles by wagon road from Kawich, with but one small spring between and a road heavy with sand. It is a wearying journey at best, and men and animals are glad indeed when camp is pitched. Here there are prospects of gold and of copper; azurite fine enough to be cut and set in jewelry is found, and some of it has been shipped for that purpose.

From the top of the Oak Spring Butte a panorama of interest unfolds: To the west and north the high plateau region, besprinkled with scattering cedar and piñon trees, cut by sharp-walled canyons, and limited by the backbone of the Belted Range is one of the most arid parts of the desert. To the east and south is the long sweep of an unnamed valley, the slopes of drift reaching from rock-walled range to the white enamel lake bed far in the distance. Across this valley we journey. The road, often sandy and slow, is relieved by stretches hard and smooth, which are in themselves a rest to horse and rider. In the bottom

we find a great tank of water; it resembles a stream without flow, head, or mouth. The water surface is perhaps 200 yards long, 2 to 5 yards wide, and has a maximum depth of 3 feet. We are fortunate in that a fierce thunderstorm with heavy rain passed a day or so before and filled this reservoir, which had been dry for months, to overflowing. The water is already dark brown and alkaline, but we fill every canteen and barrel and journey onward for the next permanent water.

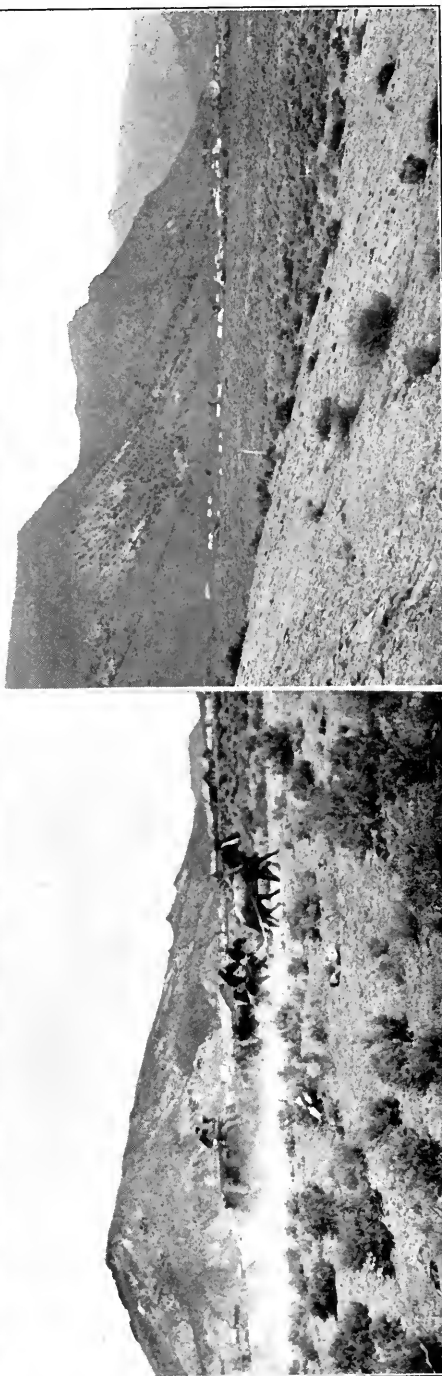
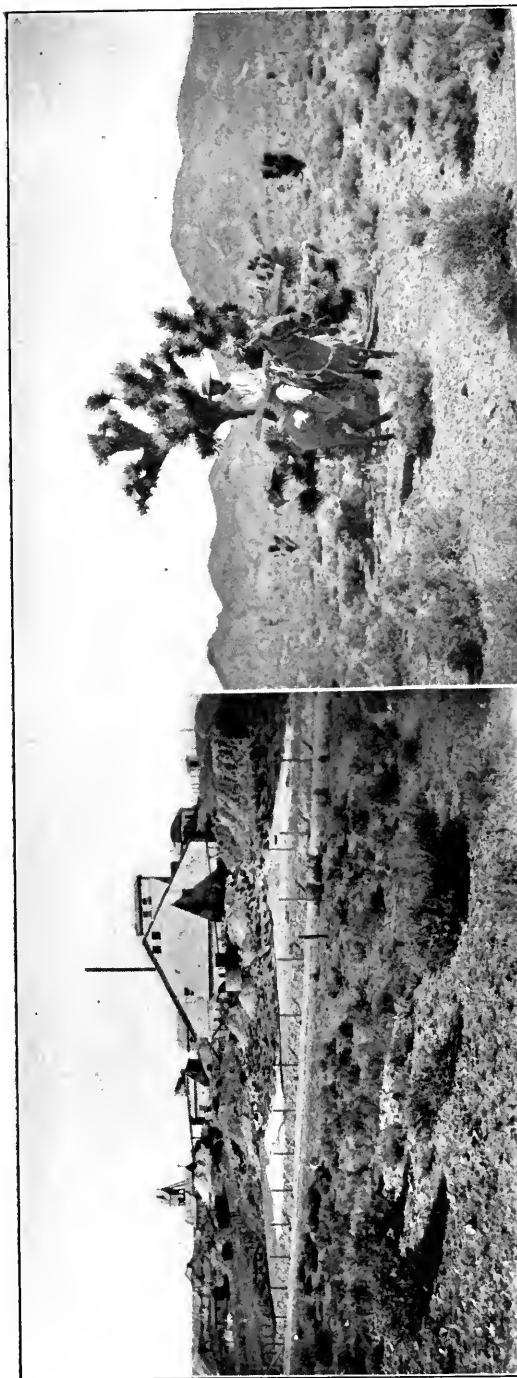
The road rises slowly to pass between low buttes, and we find ourselves surrounded by giant yucca, or Joshua, trees; some of them are large and spreading, but give little more shade than a barbed-wire fence.

When we reach the Cane Spring, one of the watering places on the old emigrant road—when to reach it from the north a dry journey of 70 miles was necessary—it has taken us three days from Oak Springs, and the distance is not more than 35 miles. Here the tired, emaciated horses rest, wander in the barren hills seeking grass and finding sage brush, greasewood, and creosote bush.

Grain, which should have reached us, has not come, and we are distressed and worried lest more animals die and leave us stranded. We estimate it is 40 miles to the nearest hay—at a stage station on the freight road from Las Vegas to Bullfrog. We choose a light wagon, the four freshest animals, and succeed in getting back with a few bales in time to keep our bony quadrupeds from starvation.

For many weeks we have been skirting the edge of the area indicated as dry. It has been necessary to make small shelter camps far within the area and to haul water many miles across the trackless flats.

There are quite a number of animals that leave tracks and marks near the water-holes. During certain months thousands of wild doves flock from desert flat or bench land to spring or tank. These flights and rabbit trails converging toward a single point are of great as-



The Combination Mill at Goldfield
Traveling by Coach through the Desert

Photo by Robert H. Chapman

Giant Yucca or Joshua Tree
Silverbow, a New Camp



Photo by Robert H. Chapman

Marble Canyon

Route of old trail to Owens Lake Valley

sistance to one in search of water. Humans use many devices—usually heaps of stones or cairns or small sticks placed as pointers; these may be of great comfort or encouragement, though if the tank proves dried up, or to have been emptied by some wandering prospector to save his burros and fill his canteen, much distress and anxiety may follow.

From the Cane Spring we turn westward, and the Grapevine Range before us rises 3,000 feet from the Amargosa Desert—a great sand dune, long a landmark to the traveler from Ash Meadows to Beatty Ranch—stands in the desert, which has heretofore claimed more than one victim. Before turning our faces toward Death Valley we proceed across the sloping plane to Bullfrog to replenish our food, overhaul our outfit, tighten water barrels, repair canteens, and arrange for forage which is to be hauled to us.

The towns of Bullfrog and Rhyolite are practically one, while Beatty is four miles east. The latter is situated on the Amargosa River, a small stream, but usually one has to dig to find it. I can give no figures as to population, for the inhabitants in most camps are a drifting lot—there may be many hundred, even a few thousand, one day, and soon afterward but a handful, as new strikes are made in outlying districts. At Bullfrog we find rendezvous camp which has been brought from Goldfield; as we pass up the street we find the omnipresent tent, a few adobes, and one house built of beer bottles set in mud. (These materials are the only inexpensive ones to be had.) At the head of the street rises Busch Mountain, one of the many peaks surrounding the camp, its sides scarred with the waste from prospect holes. One of our first experiences is to take a swim in a tank of goodly proportions fed by clear green water brought many miles in pipes. It is useless to try to express the joy and delight which comes in sporting and romping in the water, while parched bodies absorb the fluid until we are exhilarated as by a strong stimulant. It is

our first wetting in—I blush to say how long! At Beatty we find a modern hotel with a wonderful variety of refreshment, solid and fluid, served to a nicety, including hammered-brass finger bowls, by men in conventional black evening clothes.

We look southward across the Amargosa Desert, stretching farther and farther until lost in the blue and amber of miles of heat with glittering sand and mud flats, flanked by the Bare and the Grapevine ranges, with the high peaks of the Funeral Range appearing beyond.

From Bullfrog the route lies across an extension of the Amargosa Desert to the Grapevine Range, to reach which we pass from arid Nevada into California, which here is hardly so luxuriant in foliage as its reputation might lead a stranger to anticipate, and at a boundary-line post set up for work.

THE DEATH VALLEY

Twelve miles southwest camp is made at the Daylight Springs, on the crest of the divide between the Amargosa Desert and Death Valley. We journey to one of the high peaks of the Grapevine and look into the "Valley of the Shadow of Death," as desolate a view as may be found.

In the distance the Telescope Range rises to an elevation of nearly 11,000 feet, while at our feet the salt-white plain is more than 6,000 feet below us and well below sea-level. The flat is 25 miles away, and on its borders not a vestige of vegetation appears. The valley was named Death Valley from the loss of members of parties of emigrants who attempted to pass through it in 1849, and since then a number of persons have been lost, keeping up the sinister record as a graveyard, but the appalling stories of the number of persons perishing there each year are exaggerated. It is not safe to go into Death Valley for active work during July, August, and September, though there are persons who remain there all summer; but in October we journey from Daylight Spring down hill,

mile upon mile. A sign painted upon a box lid stuck into a pile of stones gives us the cheerful assurance that we may be well provided for if we are found; it reads: "Rhyolite Undertaking Company, funeral directors and embalmers."

The canyon walls rise above us, not high, but sharp and steep, and it is only by turning and looking backward that we appreciate the greatness of the range we have crossed. The grade is easy, the road wide, sandy and gravelly, our horses grow weary and move with deliberation; all are oppressed with the feeling of weariness and lassitude.

We ride from the canyon mouth to the edge of a sandy plain, and here, 115 feet below sea-level, find a couple of holes, 5 feet in diameter and about as deep, with two feet of water in them. This is the "Stovepipe" Spring, so named from the fact that it was long marked by a section or two of that useful flue, placed upright, to inform the wayfarer where to dig when the holes had been filled by drifting sands hurled forward by the furious gales, burying deeper and deeper all vestiges of the water so necessary to life itself. We are indeed in *the Valley*; around us the sand drifts in little sheets; here and there a surface of broken and ragged saline material, hard and as rough as though made of giant saws set with teeth edge up.

We turn to the eastward; in the foreground the gritty beds of conglomerate and hard clays show as low hills backed by the ragged cliffs of the Grapevine, banded, rugged and grim. To the northward the cliffs and peaks guard this valley of desolation, the long delta fans of drift material spreading like great hands from the mouth of each canyon, burying from sight all vestige of the underlying rock, each a silent witness of the cloud-bursts, which sometimes come roaring down the rock-bound clefts, to spread and evaporate like magic in the fierce rays of the sun. The farthest fan marks the mouth of Titus Canyon, named for the young Coloradan who left Bullfrog about the time we reached Goldfield, and

perished in its lower reaches seeking life, as attested by the message penciled upon a sliver of stick broken from a provision box and left sticking in the sand for the guidance of his companion: "Have gone down canyon looking for the spring; have been waiting for you.—TITUS." His remains were found; those of the friend are still resting undiscovered.

Across the flat we journey, our light vehicle loaded to its limit with food, forage, and water, the mules weary before starting.

Dunes surround us, 20 to 30 feet high, representing the struggle of plant life to keep its branches above the accumulating drift and its roots near enough water. The victory is eventually with the sand, into which wheels and hoofs sink nearly a foot, or when a harder surface is found it breaks like crusted snow, letting the beasts into a soft substance which they dislike exceedingly. Through such ground we can move but a few yards without stopping.

In places great boulders obstruct the trail, among them the wagon must twist and turn through the fickle and shifting sands which often hide all signs of previous travel.

About 25 miles southward from the Stovepipe Spring, Furnace Creek flows from the lower part of a large wash which heads in the Grapevine Range. Here is one of the properties of the Pacific Coast Borax Company, which years ago constructed small irrigating ditches, sowed hay and planted trees, built houses, and established a plant for the treatment of the salts in the flat near by.

At 225 feet below sea-level are about 100 acres of emerald-like fields, long rows of fig trees, and abundant running water, while behind the frowning cliffs and sharp peaks of the Funeral Range guard the valley from the advance of the treasure-hunter from the east.

The borax plant is now idle, though the valuable beds are still owned by the company, which maintains a resident superintendent or foreman. The white flat which we saw from the mountain is

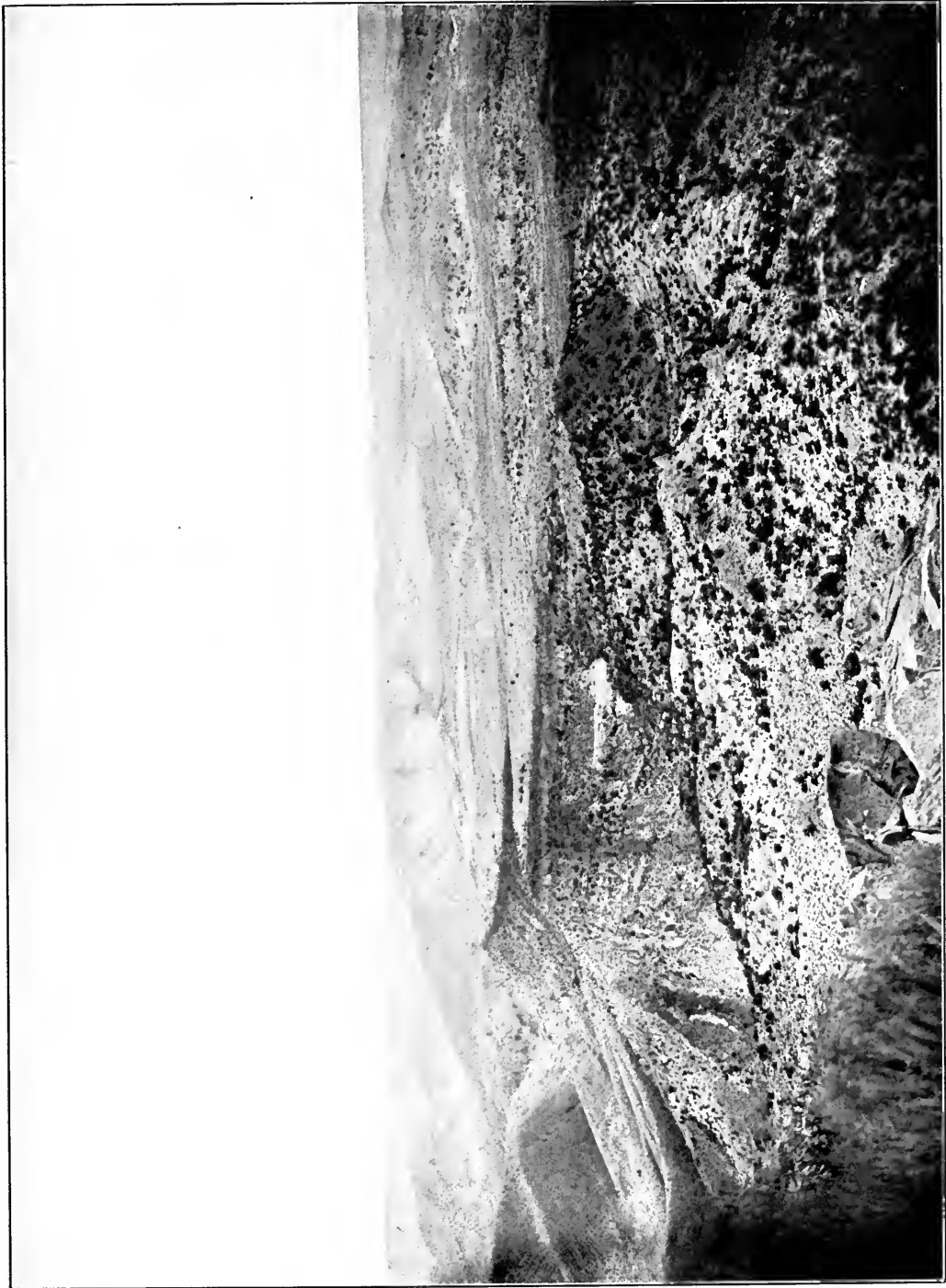


Photo by Robert H. Chapman

Plateau in Great Dry Area, Southern End of Belted Range
View from Oak Spring Butte

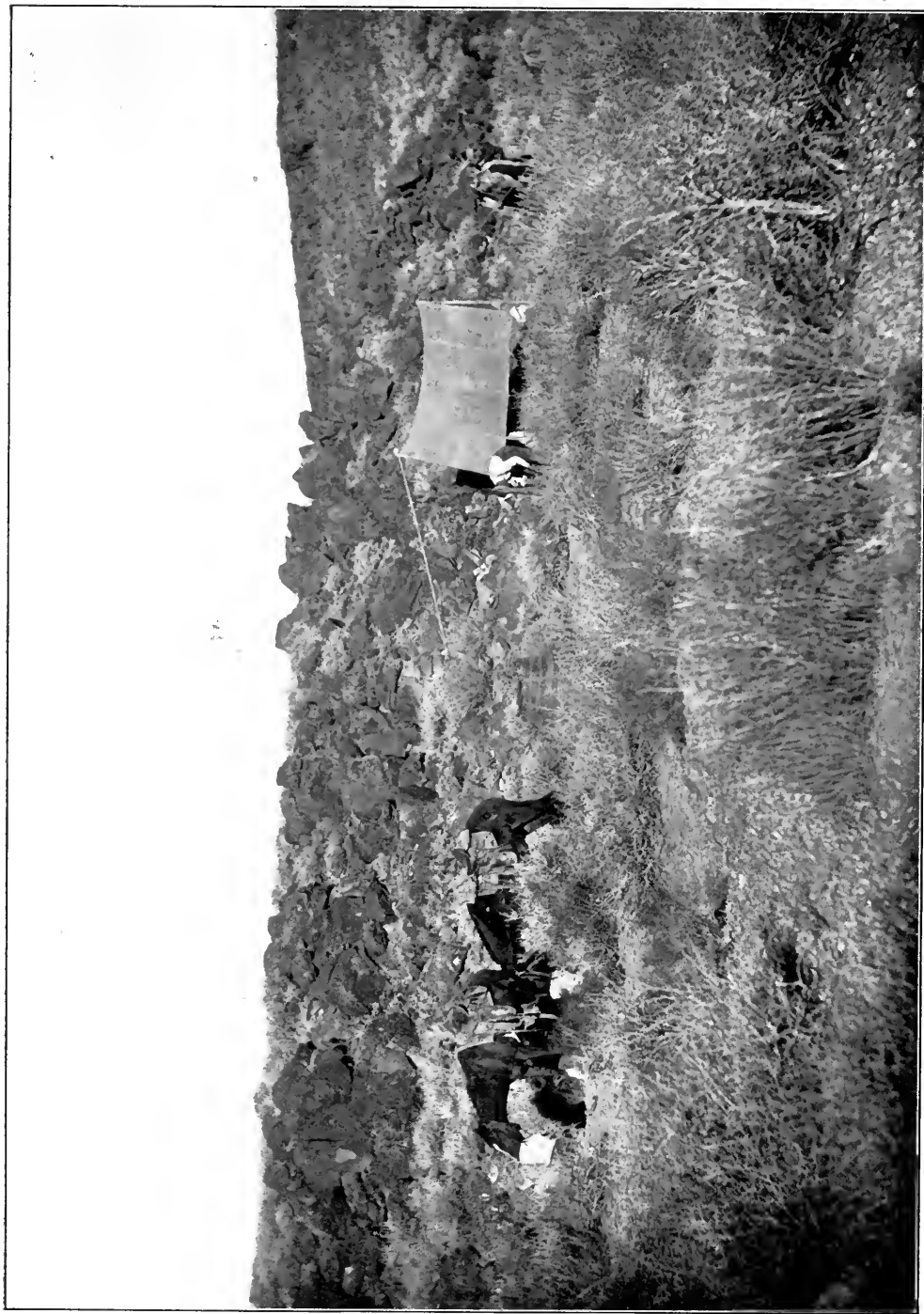


Photo by Robert H. Chapman

Shelter Camp in Great Dry Desert, 27 Miles from Water

composed largely of salt,* borax, and gypsum. The surface is as rough as can be imagined; it consists of ridges, blocks, and plates on edge, inclined, and flat, with shallow drains full of dreadfully salt water. From these drains the mixture of salt and other material is taken, molded into forms, and set up at various places to mark the corners of the mineral claims. This material dries out, and, when the molds are removed, stands like solid marble blocks, which remind one of the fate of Lot's wife. Here we are informed that during the summer the temperature reaches more than 130 degrees in the shade, and that the nights are too hot for sleeping, but during our visit in November the weather was beautiful except during the fierce sandstorms.

Much of the real development in Death Valley has been done by the parties interested in borax, which is found here and in many parts of the desert region. The "cotton-ball" (borate of soda) is found in the flats, but "colemanite" (borate of lime) is found in the hills and mountains, high above the flats of the valley bottoms. At one time it was attempted to refine borax at Furnace Creek, but no work of gathering or treating is now done there. The freight teams of the company bring provisions every few months. From here the now-famous 20-mule team hauled to Mojave; such teams are often seen along the lines of communication in the desert, but few have so many animals or such heavy wagons.

There is one way to become famous in Death Valley—that is, to die near to a trail so that one's remains may be found. For instance, meeting a man one day, I inquired about the route, water, etc. He said: "The road is plain for ten miles,

when you'll find a well about 100 yards to the right; the water is salt, but your mules will drink it. Six miles farther you'll come to 'Tim Ryan, Aug. 9th, '05,' and two and one-half miles southeast of him you'll find plenty of good water."

From the valley where, even now in November, the temperature is between 80 and 90 during the day, we cross to the Panamint Range. At the mouth of Cottonwood Canyon we halt for lunch, having covered eight miles during the morning, and find numerous hieroglyphics on the walls. These illustrate Indians fighting over water, and depict a running stream, the bighorn sheep, and various animals and birds.

Twelve miles up this wash we find cottonwood trees, some grass, a running stream, and quantities of watercress, which the mules attack with evident relish. Here we find numerous prospectors, learn of an abandoned camp to the north, and water and trails everywhere.

In the Grapevine and Panamint ranges there are still a few mountain sheep. Tracks near water-holes and a few old skulls are the nearest we come to a view of these shy animals.

To the northward we follow along the range, often in sight of our valley camp miles away, and 48 hours after leaving the summit of the valley we are camping 9,000 feet above it, wading in snow varying from ankle to waist deep, with shoes and stockings frozen hard, the thermometer near 0°, and a cruel wind—a most trying change for man and beast.

In the Panamint Range both sedimentary and volcanic rocks appear, and near one of the contacts of these we travel up a wonderful canyon. The walls are so near to one another that on horseback one may touch both at once. The material is limestone that has been baked into marble of alternate beds of black and white, about a foot in thickness. This trail is one of the old Indian routes to the Valley from Keeler and the Sierra Nevada.

From the summits of the Panamint

*Chloride sodium	94.54
Chloride potassium	0.31
Sulphate sodium	3.53
Sulphate calcium	0.79
Moisture	0.14
Gypsum and clay.....	0.50

99.81



Photo by Robert H. Chapman

In the Death Valley

Surveyor's well (65 feet below sealevel), dunes, and mesquite roots

Range we look into the Panamint Valley. Similar to Death Valley in form, but a little higher in elevation, the floor is 6,000 feet below the mountain tops and about 1,000 feet above sea.

Death Valley is by no means the driest of the regions traversed, but the heat and heretofore the inaccessibility have made it difficult. In the mountains flanking it are numerous springs and frequent water-holes which, though dry in summer through excessive evaporation, are available during the fall and winter. There are many springs that are credited as poison water; one of these we sampled, but unfortunately the bottles were broken before analysis could be made. In my opinion, there are springs in which arsenic is present, but most cases of sickness or death are probably due to drinking excessive quantities at one time, followed by physical exertion in the heat. Such springs as the Indians will not use are better left alone or used in extreme moderation, by no means an easy thing for one throat-parched and speechless for need of water. Each spring is a source of supply for flocks of birds, many of which are very tame.

The desert region is being rapidly invaded by the various transportation companies, replacing the primitive methods. The Tonopah and Tidewater Railroad is building from Ludlow, on the Santa Fe Railroad, through the Amargosa Desert, to the mines at Bullfrog, with connections

to the borax mines en route. The railway from Las Vegas, on the San Pedro Railroad, to Bullfrog is under construction. These roads plan to run through to Tonopah, which will make prospecting much easier and less expensive, give a stimulus to the production and shipment of ores, and make profitable properties that would be practically valueless without them; they will lessen to a great extent the difficulties of travel. With these and other changes the desert will repay many fold those who seek its treasures of gold, silver, and lesser metals and materials.

The traveler in the deserts should be sound in heart, kidneys, and liver; have calm judgment; obtain all information possible of watering places before undertaking a journey; never leave camp without some food and water; discount from 30 per cent to 50 per cent the physical efficiency of himself and his animals, as experienced in other, cooler, fields, and abstain from alcoholic drinks, especially when doing physical labor. Many cases of collapse and death are due to alcohol or overestimation of strength.

Great mountains are a joy to the lover of nature; they are an inspiration to the artist, and express grandeur and nobility. The desert has no such spirit, but has a wonderful fascination, born of the impressiveness of magnificent distance, limitless sky, and the infinite patience of an unbreakable calm.



